

# AGENDA

- Project Goals
- ATMS Components
- Field Concept
- System Highlights
- System Components
- Modeling
- East Dubuque Project
- SMART Grant
- Discussion



## SMART TRAFFIC ROUTING WITH EFFICIENT & EFFECTIVE TRAFFIC SYSTEMS (STREETS)



# PROJECT GOALS



- The goal of the STREETS project is to develop a smart, next-generation traffic management and control system.
  - Serve as a framework nationally for deploying similar systems in small urban areas
  - Reducing wear and tear on major corridors
  - Reduced congestion
  - Improved travel times
  - Improved safety
  - Reduced emissions
  - Enhanced system monitoring capabilities
- React dynamically to events and congestion detected/predicted by the Micro-simulation model and proactively change signal timing based on predicted traffic flow data while disseminating congestion and alternate route information for motorists.
- The ultimate deployment of STREETS will cover fifteen (15) corridors with 72 primary signalized intersections and an additional 48 secondary signalized intersections within the City of Dubuque.
- The deployment includes:
  - First-of-its-kind, fully-automated traffic control program
  - Utilizing AI based video analytics to collect real time traffic conditions
  - Simulates future traffic conditions (based on real time modeling)
  - Automatically adjusts signal timing for maximum efficiency during unusual events or traffic conditions
  - Provides travel times along the major routes in the region to support dynamic routing.

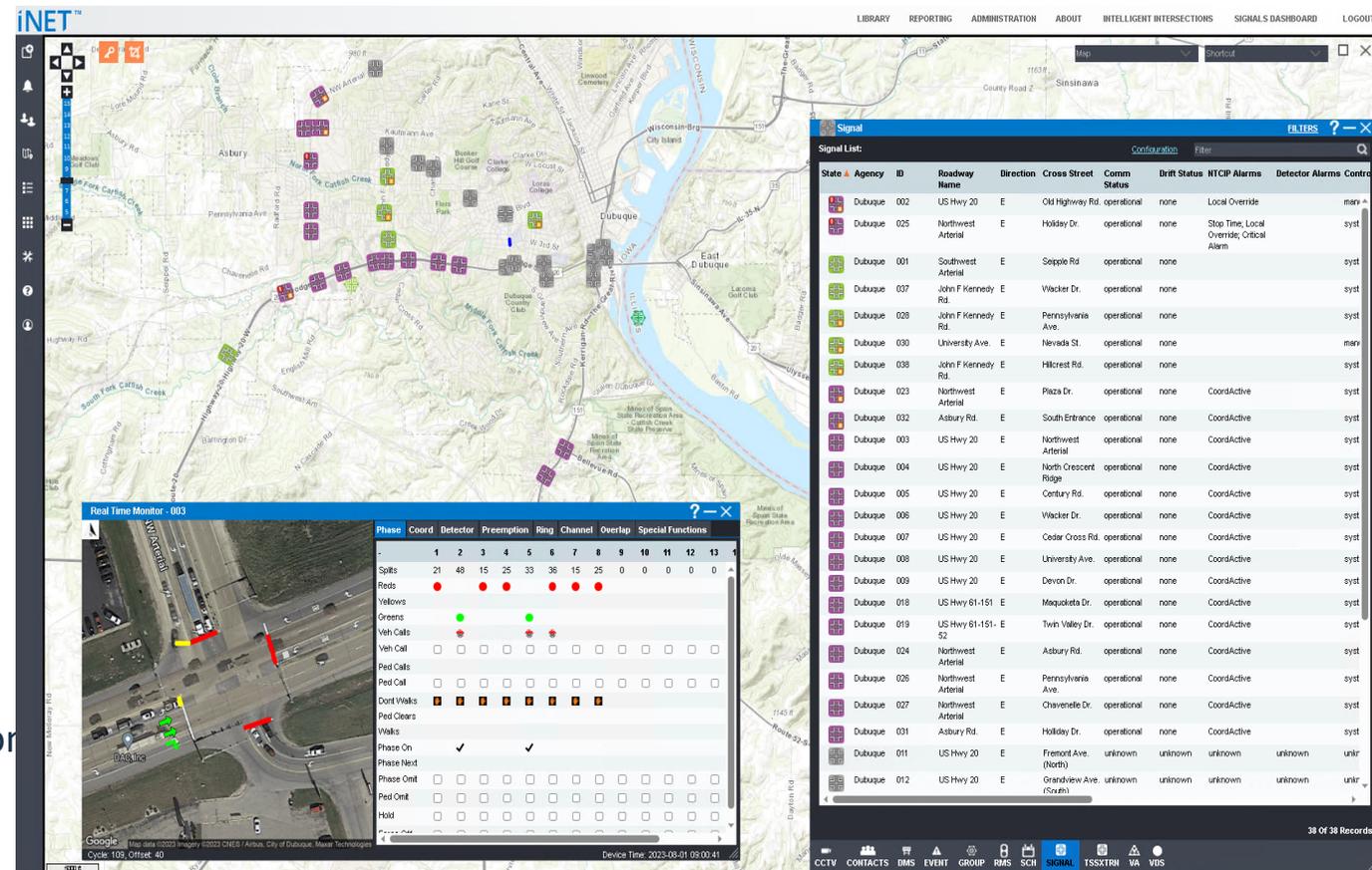
# ADVANCED TRAFFIC MANAGEMENT SYSTEM COMPONENTS

- Base ATMS Components

- Map based monitoring and control
- Event Management
- Automated Responses
- Travel Times
- DMS Control
- Administration
- Health monitoring of infrastructure

- Dubuque Advanced Features

- Full centralized traffic signal control
- Automated Traffic Signal Performance Measures (ATSPM)
- Utilize Video Analytics & Arterial Incident Detection
- Real time Modeling integration
- Public Web Site
  - Responsive web design



# VIDEO ANALYTICS

- Used to provide:

- Turning movement Counts
- Queue detection
- Stopped vehicle alerts just added
- Can also detect vehicle types and Ped.

- Internal processing

- Number only limited by servers and GPU
- Models can be trained

- Can integrated third party also

- Counts feed into the model

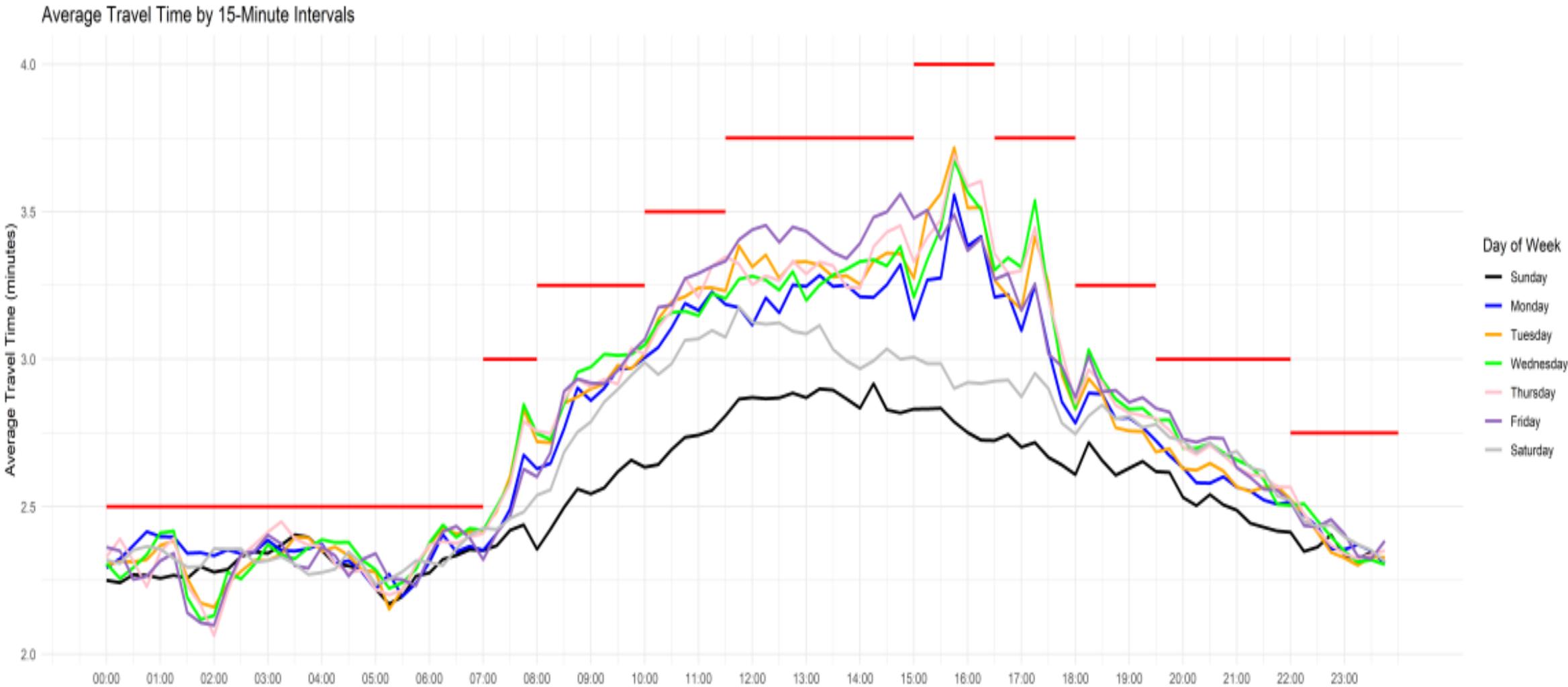
The screenshot displays the iNET software interface. The top navigation bar includes 'CCTV', 'CONTACTS', 'DMS', 'EVENT', 'GROUP', 'RMS', 'SCH', 'SIGNAL', 'TSSXTRN', 'VA', and 'VDS'. The main content area is divided into several sections:

- Top Left:** 'NW-Arterial-Chavenelle SB : NW S at Chavenelle' with 'Mile Post: 0', 'Last Poll: 2023-08-01 14:51:20', 'Status: OK', and 'Agency: Dubuque'.
- Top Center:** Three gauge charts for 'Speed' (0-120, NA), 'Volume' (0-40, Station Average, 20), and 'Occupancy' (0-100, NA).
- Center:** A table with columns for Lane (1-4) and rows for Status, Volume (vpm), Occupancy (%), and Est. Speed (mph).
- Right Panel:** 'VDS List' table with columns: State, Device Name, Roadway Name, Cross Street, City, Mile Post, Agency, Status.
- Bottom Right:** A video feed of a multi-lane road with green bounding boxes around vehicles and green lines connecting them, indicating tracking.

Lane	1	2	3	4
Status	OK	OK	OK	OK
Volume (vpm)	996	530	2914	2930
Occupancy (%)	NA	NA	NA	NA
Est. Speed (mph)	NA	NA	NA	NA

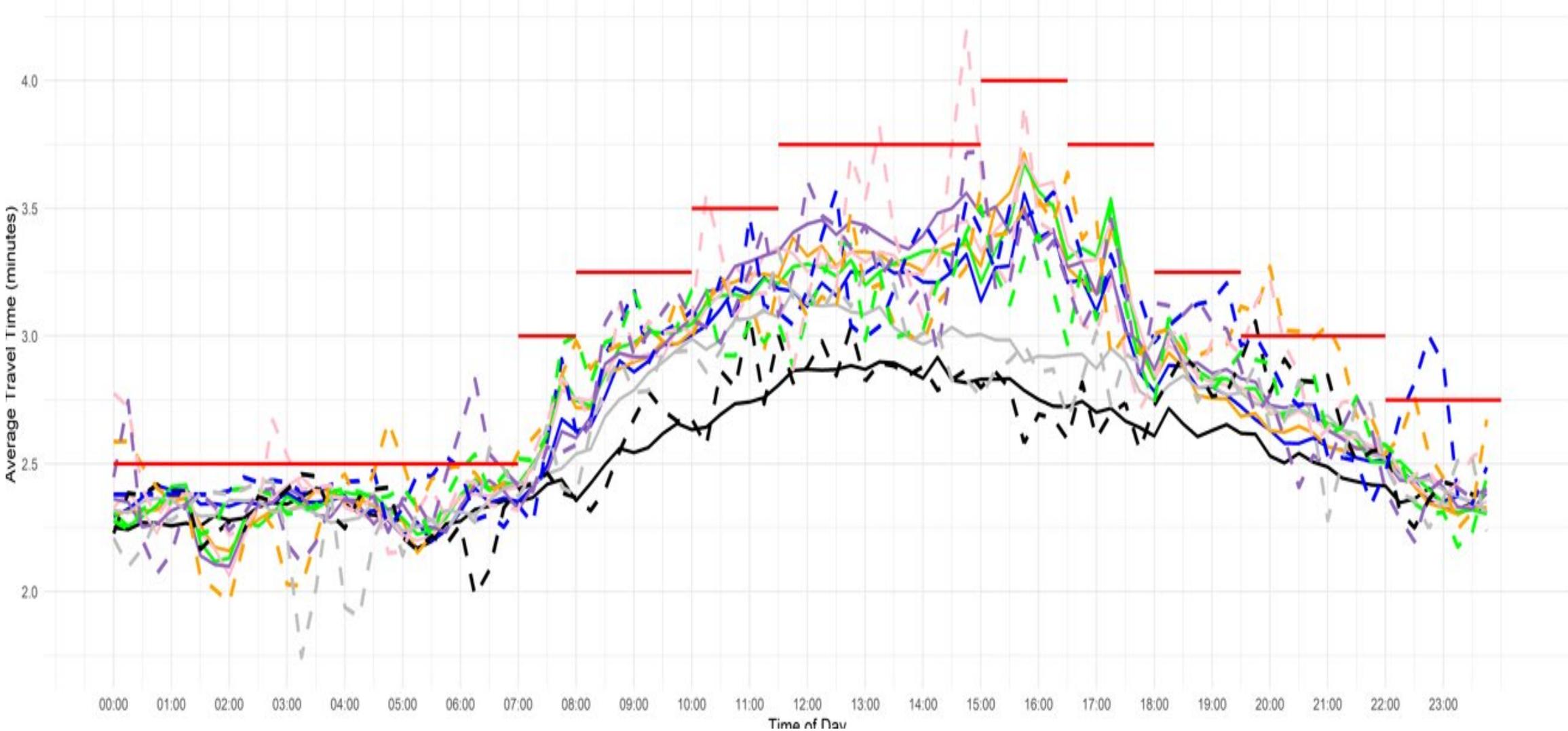
State	Device Name	Roadway Name	Cross Street	City	Mile Post	Agency	Status
●	1421495-1412828	NW Arterial	Penn			Dubuque	OK
●	1421495-1421149	NW Arterial	Penn			Dubuque	OK
●	1421495-1422203	NW Arterial	Penn			Dubuque	OK
●	NW-Arterial-Chavenelle NB	Chavenelle N	Chavenelle	Dubuque	0	Dubuque	OK
●	NW-Arterial-Chavenelle SB	NW S	Chavenelle	Dubuque	0	Dubuque	OK

# ARTERIAL INCIDENT DETECTION



# ARTERIAL INCIDENT DETECTION

Average Travel Time by 15-Minute Intervals



# AUTO RESPONSE

- Auto Response allows for a flexible way to provide specific responses to specific conditions
- Can simply provide notifications or drive responses
- Series of “and” and “or” statements set by the users
- Can be 24/7 or set by time of day and day of week
- Set up ahead of time and implemented automatically
- Sample to the right simply generates a congestion event for notification when a travel time is exceeded for 5 minutes

Auto Response

Select Automated Response: TT Section 504 exceeds normal

Condition Setup

Type	ID	Field	Operand	Threshold	AndOr
Travel Times	Section 504 - from: DODGE ST W at Wacker Drive to: DODGE ST W at Northwest Arterial	Travel Times	>	3.5	

Library Response Plan Category: [Dropdown]  
Library Response Plan Title: [Dropdown]  
Type: Traffic Conditic [Dropdown] SubType: Travel Tim [Dropdown]  
Automated Response Name: TT Section 504 exceeds non  
Delay Time (Minutes): 5 Clear Time (Minutes): 5  
Auto Activate:

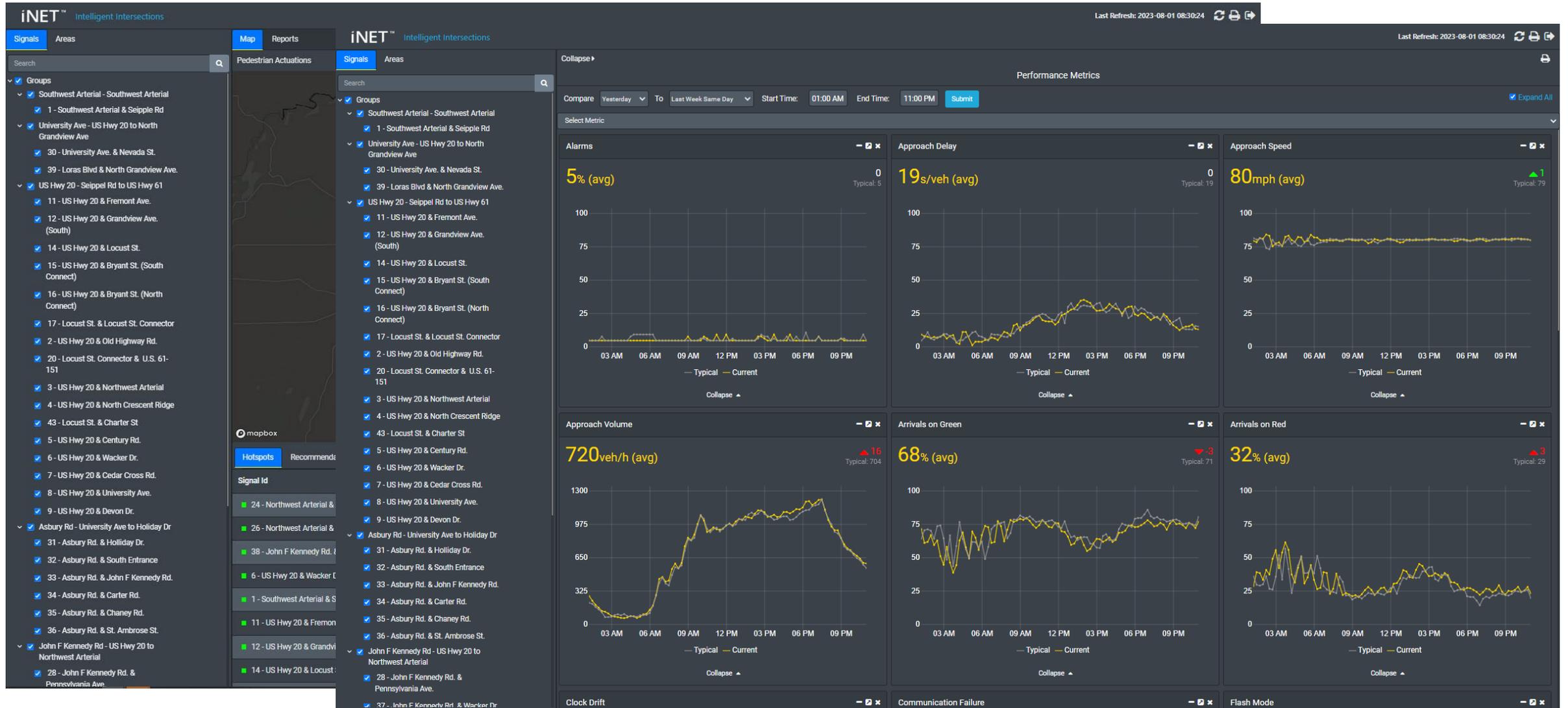
Time

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Start Time	00:00	00:00	00:00	00:00	00:00	00:00	00:00
End Time	23:59	23:59	23:59	23:59	23:59	23:59	23:59

New Save Save As New Delete

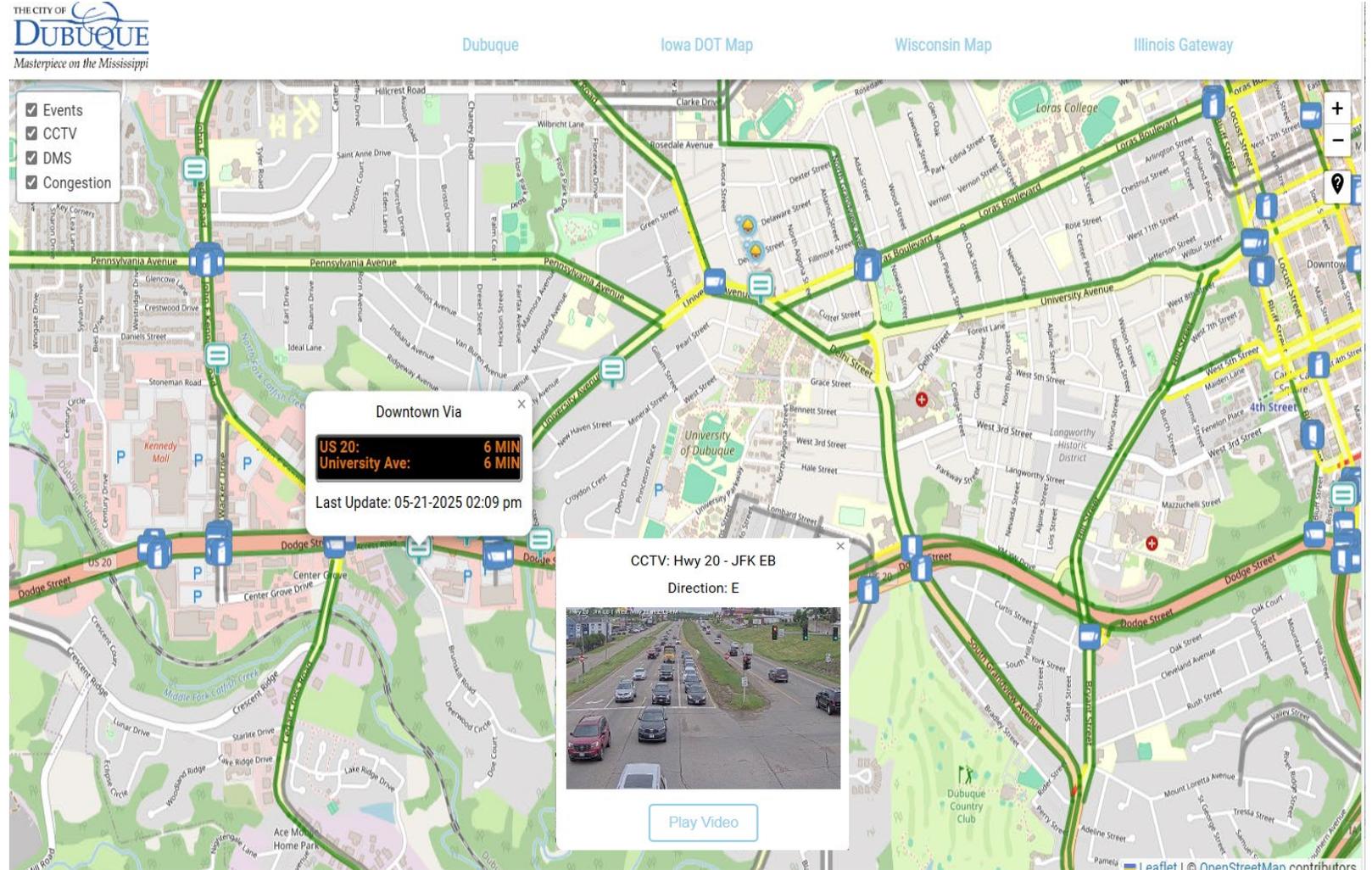
CCTV CONTACTS DMS DSS GROUP SIGNAL TSSXTRN TTPATHS VA VDS

# REAL TIME PERFORMANCE MONITORING / OPTIMIZATION

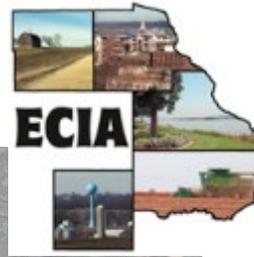


# DUBUQUE ATIS WEBSITE

- Map based
  - Events
  - CCTV (Snapshots and Video)
    - Select what CCTV are displayed
  - DMS messages
  - Travel times
  - Colored congestion segments
  - Links to other sites



# ITS Improvement Assessment Plan for Interstate Bridge Detour Routes on the Mississippi River



## Operational Review and device placement workshops

- Operational Review of STREETS (Workshop)

- ITS Devices placements (Workshop)

## Communications Assessment

- Review existing requirements/agreements

- Review existing inventory

- Review future needs

- Develop Communications plan

## ITS Device PS&E

- plan sheets 30% and 90%

- Final PS&E

- full DMS and DMS inserts

- 4 DMS signs, 9 VDS stations and 4 CCTV

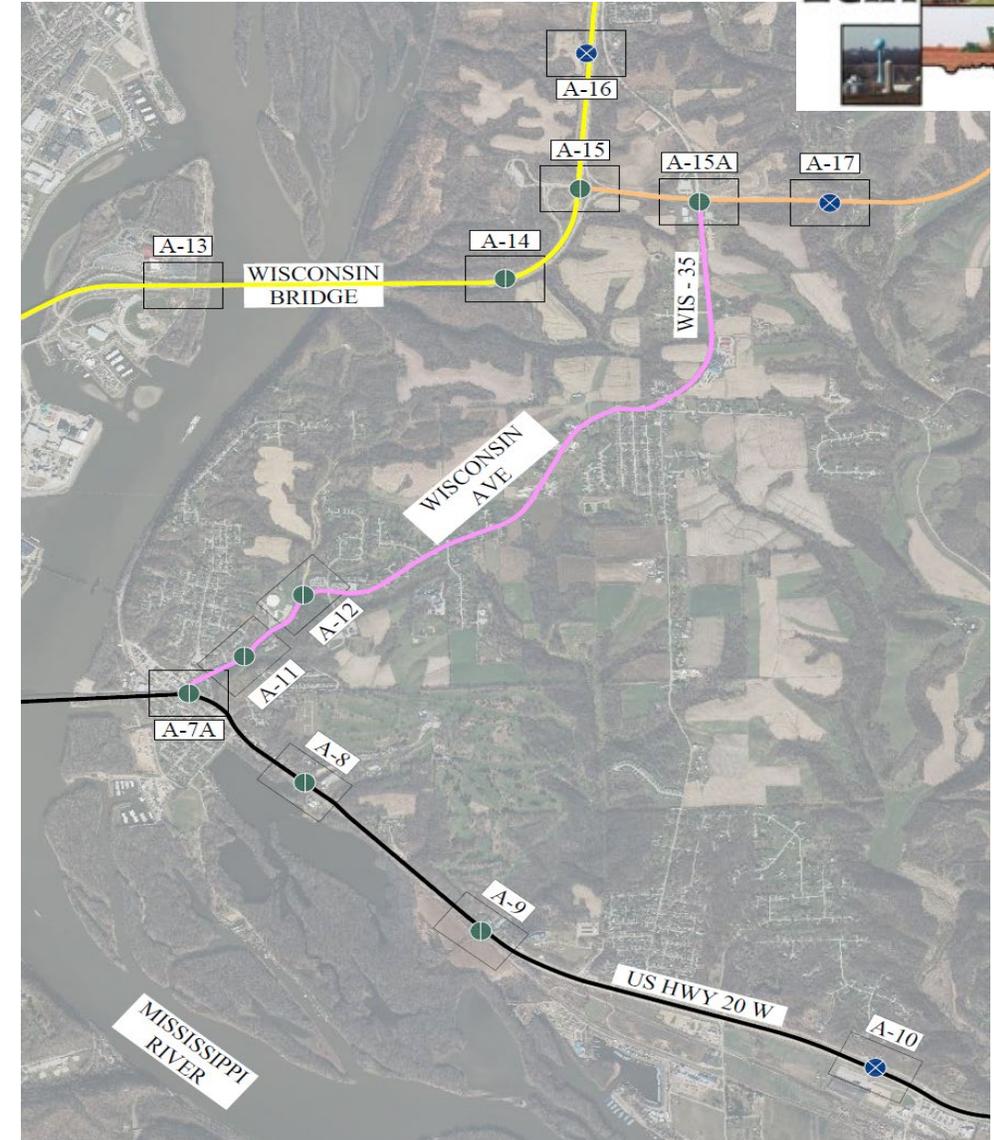
## System Integration

- VPN installation and Set up

- Integration testing

## Training and documentation

- Full set of system documentation and training material for users and administrator



# FIELD CONCEPT

- Designed to balance traffic
  - Leverages existing communications infrastructure
  - Optimizes use of existing CCTV through Video Analytics
- Two full DMS and Combination signs
  - Automated Travel time displayed continuously

A1 (EB)

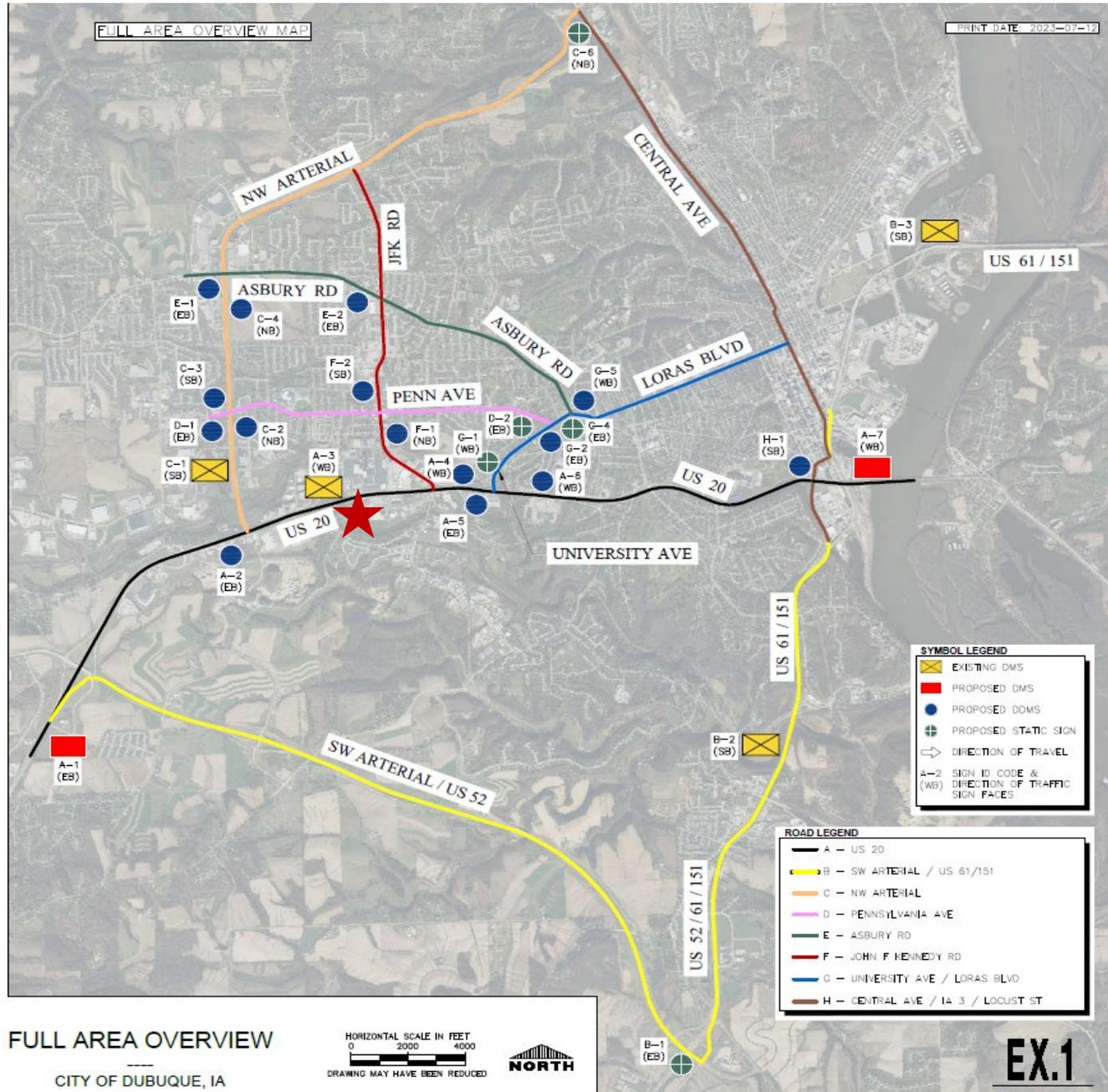
**CONGESTION  
AHEAD  
USE US 52**

A-2 (EB)

Downtown Via	↑	21
US 20		
NW Arterial	←	17

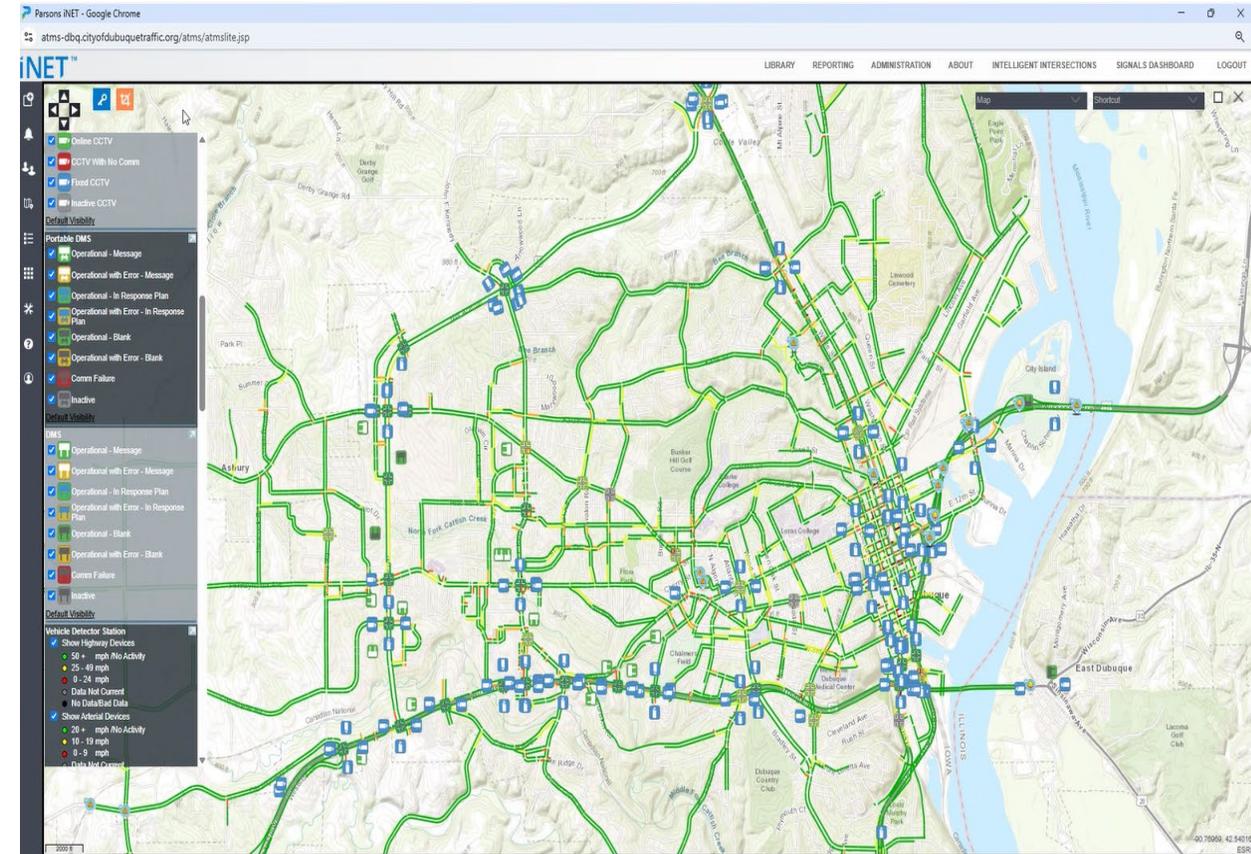
C-2 (NB)

Downtown Via	→	15
Penn Ave		
NW Arterial / Asbury Rd	↑	19

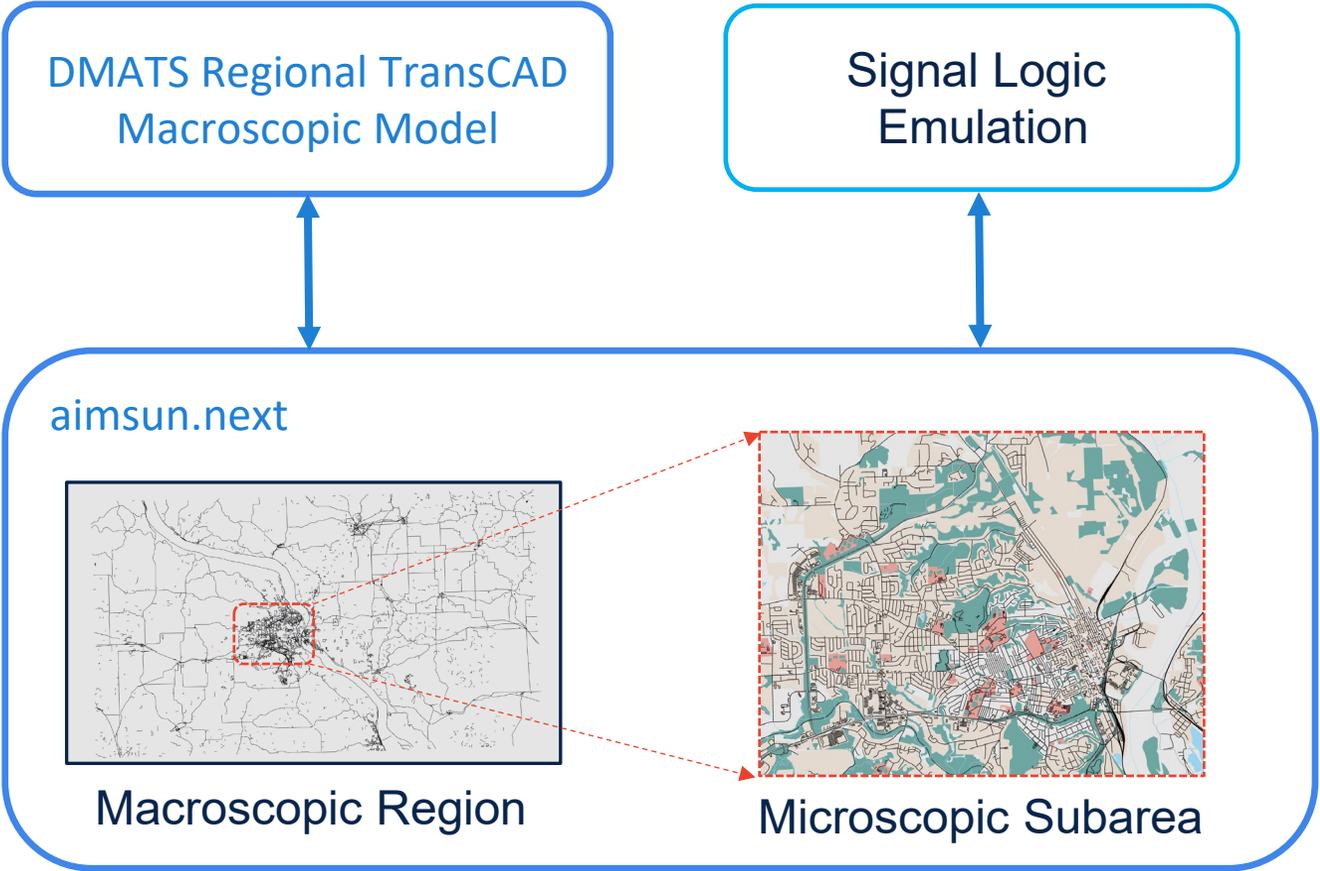


# INTEGRATED MODELING HIGHLIGHTS

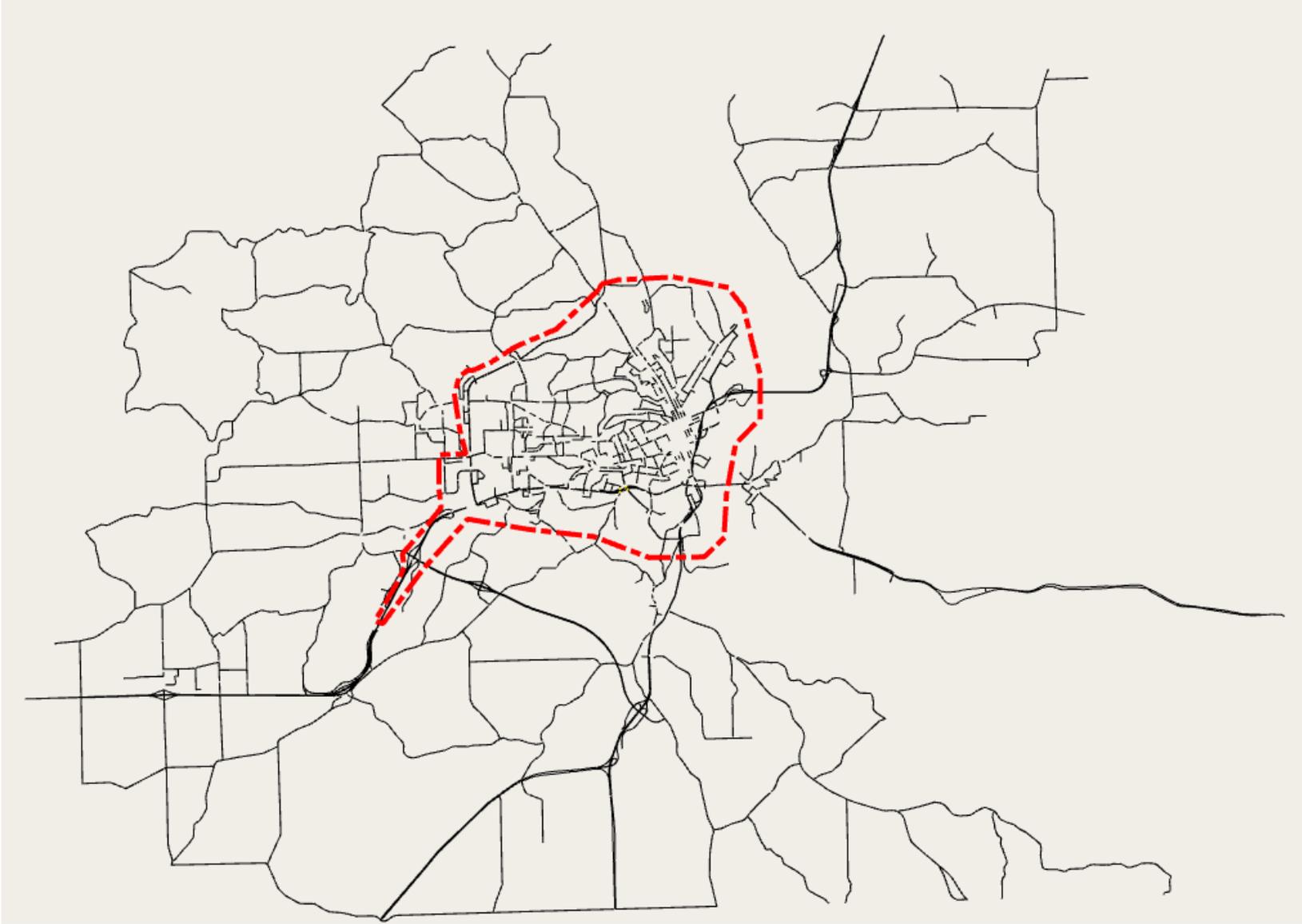
- The STREETS solution uses Parsons iNET<sup>®</sup> ATMS integrated with Aimsun Next.
  - Live model predicts near future traffic (i.e., 15, 30, 45, 60 minutes)
    - Integrates travel demand modeling, static and dynamic
    - Constantly compares the forecasted results to the future observed
  - Unusual traffic conditions detected by the real time model and/or events manually entered into the system.
  - Potential responses are modeled in the system in near real time and scored.
    - The system will allow for an operator to approve the response or automatically implement it.



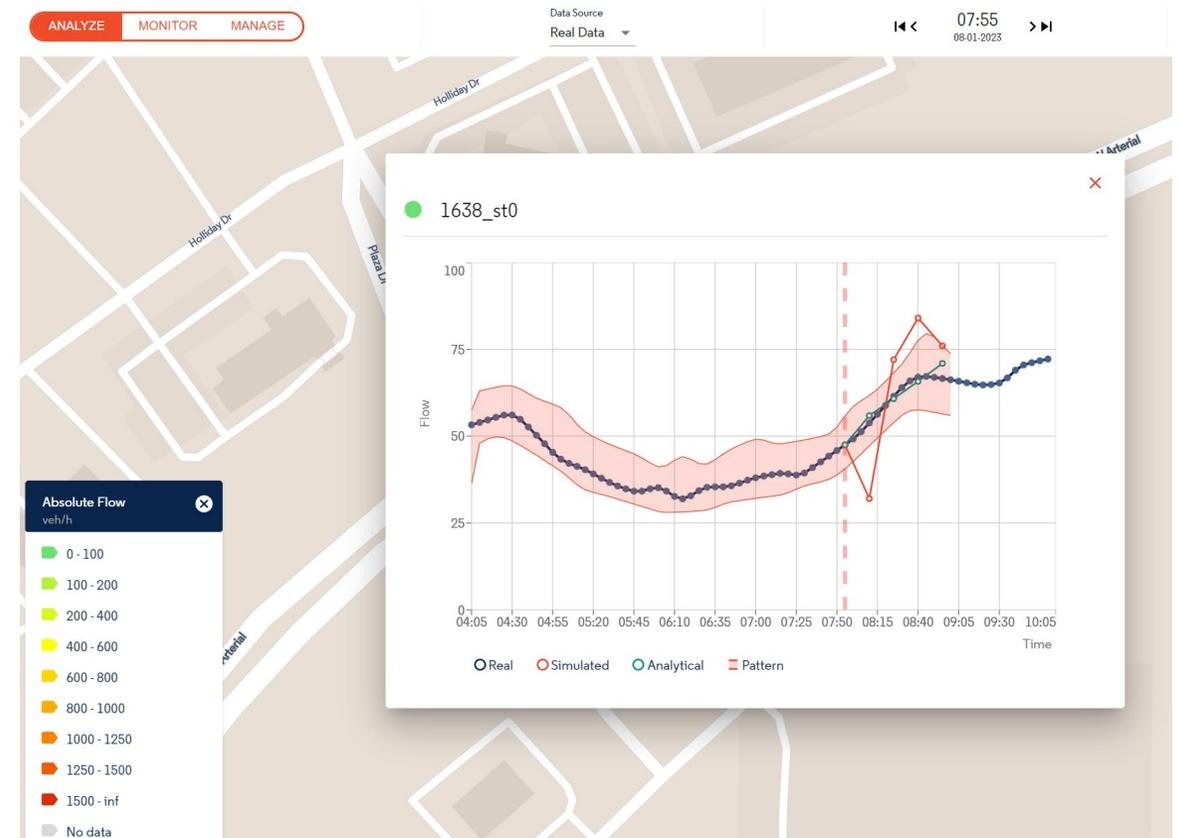
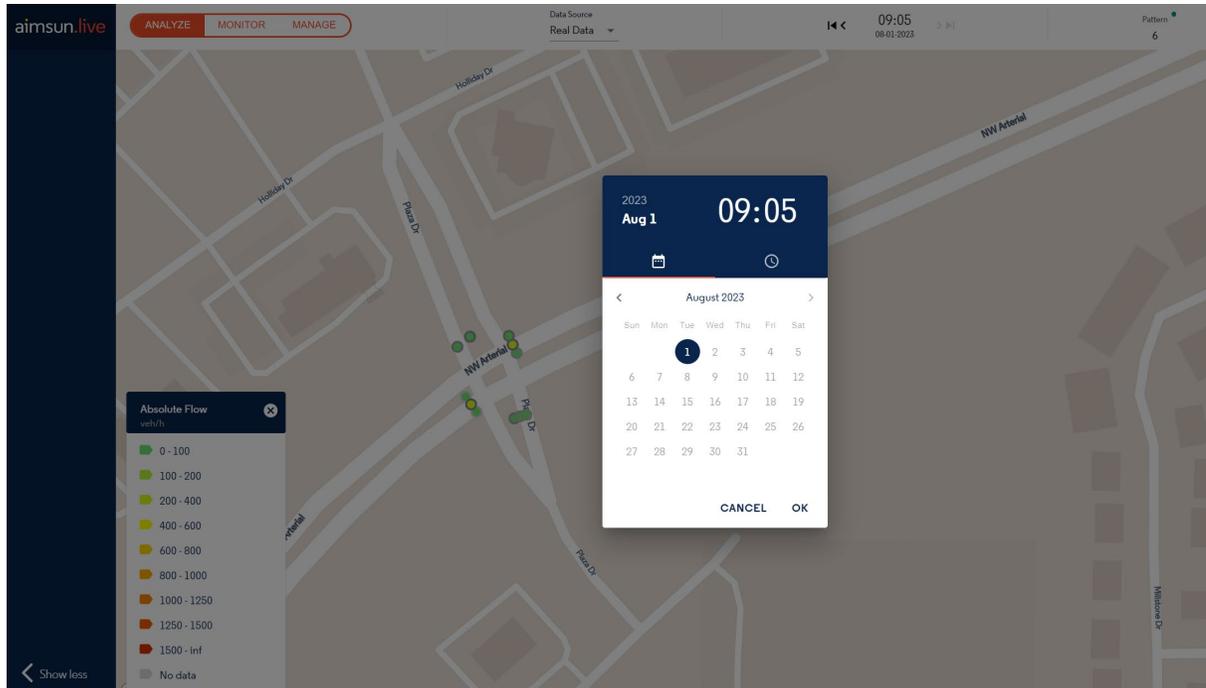
# OFFLINE MODEL DEVELOPMENT WORKFLOW



# MODEL IMPORTATION FROM TRANSCAD TDM



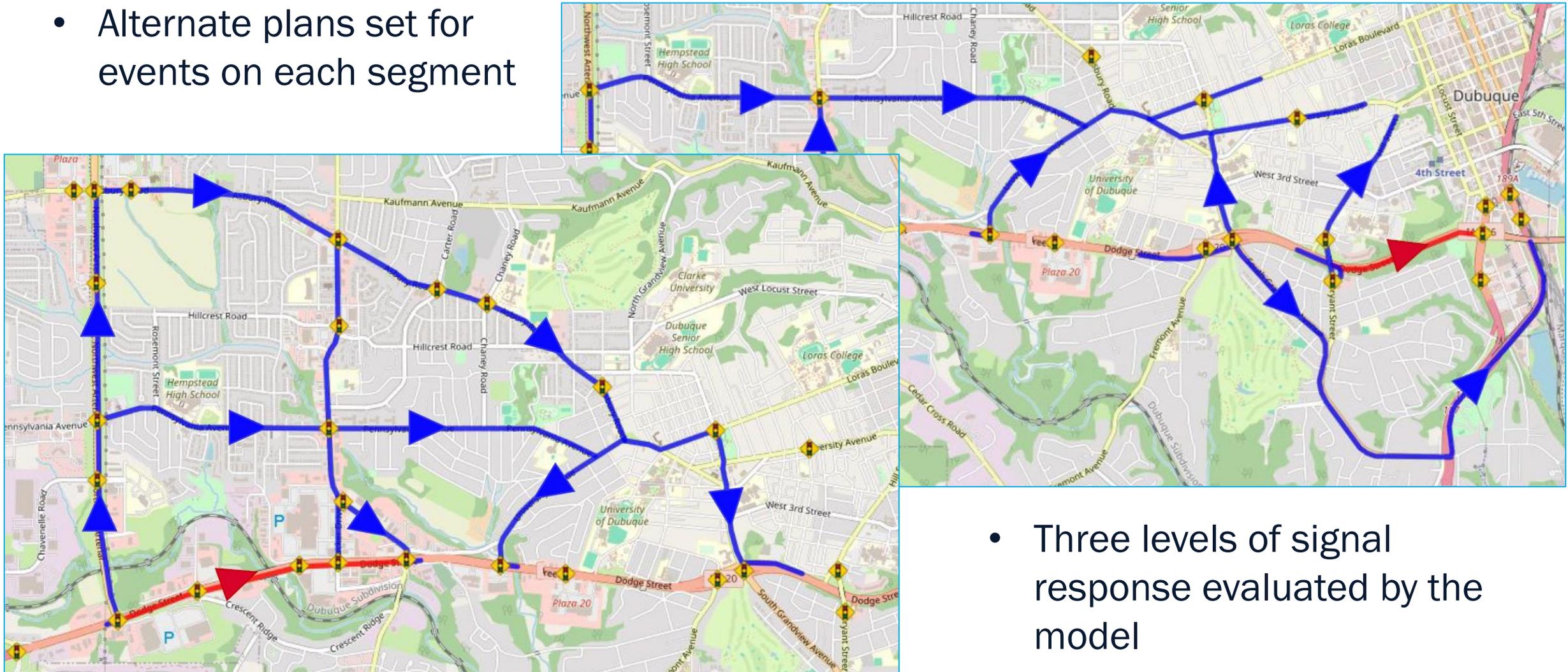
# DUBUQUE AIMSUN GUI - ANALYZE



In Analyze we can modify and check other time periods, meanwhile in Monitor is always the last prediction period.

# ALTERNATE ROUTES USED FOR SIGNAL TIMING CHANGES

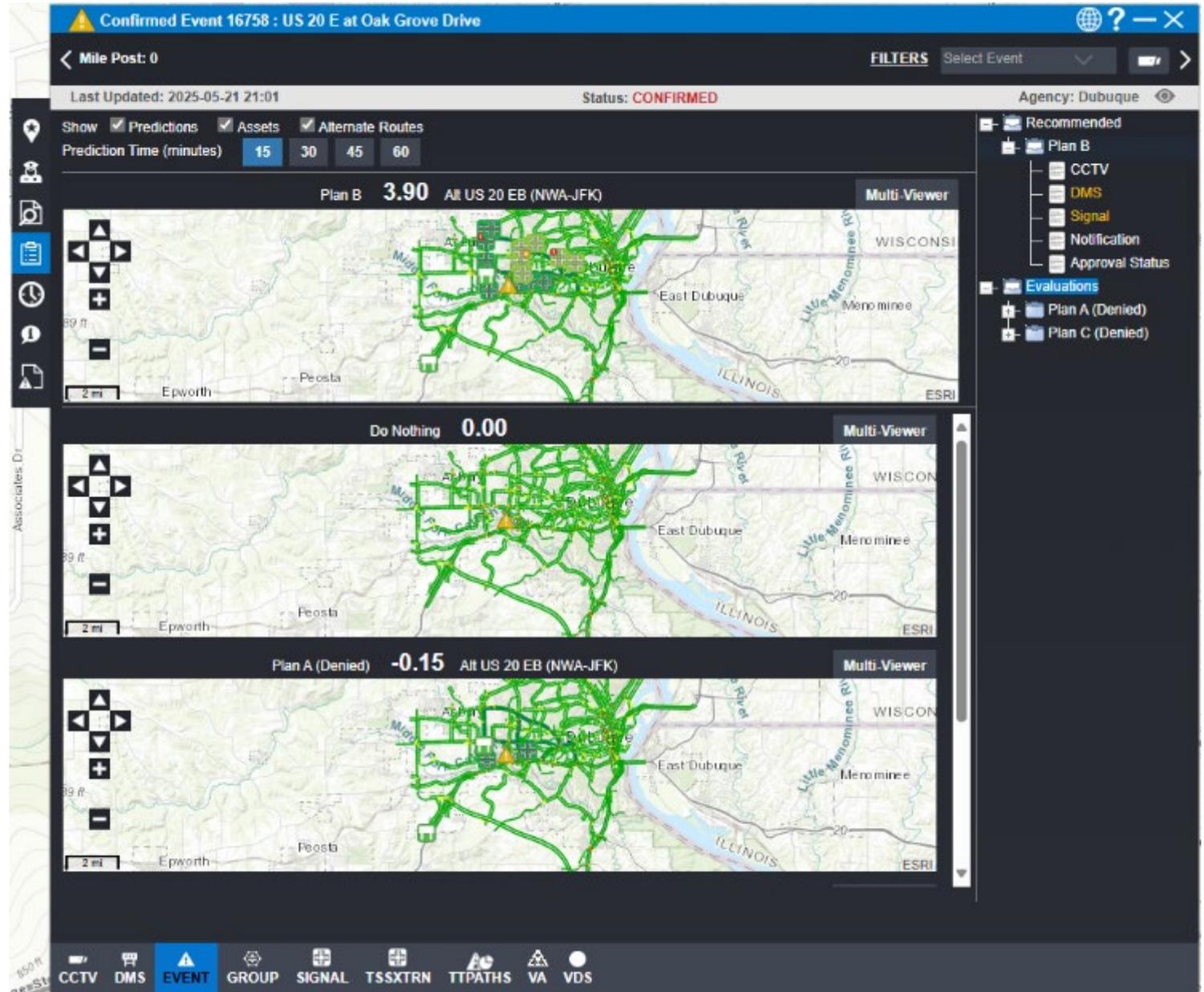
- Alternate plans set for events on each segment



- Three levels of signal response evaluated by the model

# EVENT RESPONSE

- Provides ATIS, DMS and signal responses
- Potential signal responses are modeled in real time and scored
- Highest score is best overall for region
- All compared to do nothing for the signals
- Negative may be better locally but be detrimental to overall traffic
- Plan B has best score in sample



# METRO DUBUQUE TRAFFIC DATA AGGREGATION FOR CONNECTED VEHICLES PROJECT OVERVIEW

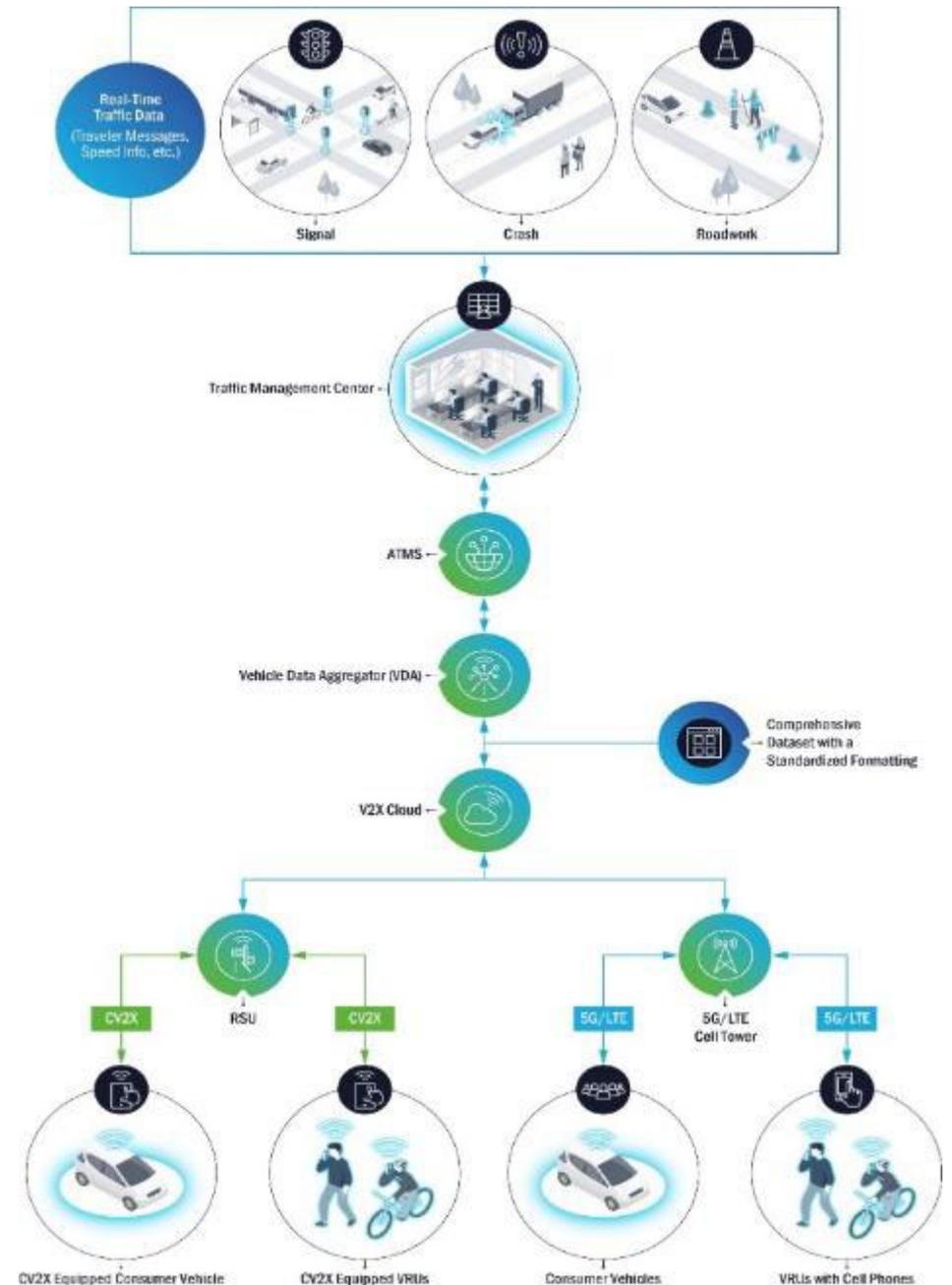


- Multi agency regional project
- The long-term goal is to deliver near real-time transportation information directly to vehicles over the cellular network via C-V2X
- First stage of 2 phase SMART Grant Program
- Stage 1 provides an open and standardized data set for integration and distribution for use in a prototype display for vehicle infotainment system integration
- Stage 2 would support filling in data gaps and throughout the region to provide a complete data set for ingestion by OEMs and other third-party applications



# SMART GRANT CONCEPT

- Original Equipment Manufacturers (OEM) are interested in getting complete transportation data sets for entire regions.
  - Dubuque perfect size for initial demonstrations
- Integrate the data in a standardized format
- Build appropriate intelligence to define distribution limits for each piece of data
- Develop an open interface to provide this data in near real time via cellular C2N connections to OEM, infotainment system providers, and other third-parties
- This solution will support providing vehicles a full set of important transportation data, when and where they need it, to support safer and more optimized traffic flow.
- ***This project has the potential to revolutionize the way transportation systems are managed and traffic information is distributed to motorists***



# THE CHALLENGE ATMS/WEB DATA FORMAT -> IN VEHICLE FORMAT



In Central ATMS

In Vehicle Infotainment Systems

The screenshot shows a web-based ATMS interface. At the top, it displays 'Unconfirmed Event 2533 : US-61 N at East 11th Street'. Below this, there are filters and a 'Select Event' dropdown. The main content area shows event details: 'Last Updated: 2024-10-07 08:00', 'Status: UNCONFIRMED', and 'Agency: DUBUQUE'. There are radio buttons for 'Unscheduled' and 'Scheduled', and a 'Type' dropdown. The 'Severity' is set to 'Low' and the 'Source' is 'Waze'. The 'Agency' is 'City of Dubuque' and the 'Description' is 'Road Work Ahead - move LEFT'. A map shows the location in Dubuque, IA, with a red marker. To the right of the map are checkboxes for 'Unknown Lanes', 'Rural Area', and 'Intersection'. Below the map is a 'Set Location' button. At the bottom, there are buttons for 'Update', 'Confirm', 'Dispatched', 'On Scene', 'Road Cleared', 'Incident Cleared', 'Queue Cleared', and 'Terminate'. The bottom navigation bar includes icons for 'CCTV', 'DMS', 'EVENT', 'GROUP', 'SIGNAL', 'TSSXTRN', 'TTPATHS', 'VA', and 'VDS'.



A grid of eight vehicle infotainment warning icons. Each icon is a square with a dark background and a white border. The icons are: 1. 'Road Works Ahead' with a yellow warning sign and '10 mi' below it. 2. 'Road Congestion Ahead' with a red warning sign and '1 km Reduce Speed' below it. 3. 'Accident Ahead / Object on Road' with a red warning sign and 'Press OK to dismiss' below it. 4. 'Slippery Road Ahead' with a red warning sign and '2 km' below it. 5. 'Bad Weather' with a blue and white weather icon and 'Press OK to dismiss' below it. 6. 'Red Light Assist' with a yellow warning sign and 'Possible Red Light Violation' below it. 7. 'Disable Vehicle' with a yellow warning sign and 'Press OK to dismiss' below it. 8. 'Wrong Way driver' with a red prohibition sign and '1 km Reduce Speed' below it.

The screenshot shows a vehicle infotainment system interface. At the top, it displays 'A W 07:37 32°'. Below this, there are three traffic lights (red, green, green) and a speed limit sign '60'. The main display shows a 'Road Works Ahead' warning with a yellow warning sign and '40 KMPH' below it, and '200 m' below that. The speedometer shows '50 KMPH'. To the right is a map showing the current location. At the bottom, there are indicators for 'Range 397 km', '90% 30°C', and 'ODO 101133 km'.

# USE RELATED STANDARDS AS APPROPRIATE

## TIM & RGA messages:

- J2945/4 which is the Road Safety Applications which is based from the original TIM standard.
- J2945/3 would be useful as well since it is for the Road Weather Applications.
- J2735 from 9/24 will also be useful for all kinds of messages to fit our use cases
- J2945/A which deals with road geometry and attributes definition which I think would be helpful to use as well

## Other standards that are related:

- Message Sets for Advanced Traveler Information System (ATIS)(STABILIZED Jun 2019)  
J2354\_201906 [https://www.sae.org/standards/content/j2354\\_201906/](https://www.sae.org/standards/content/j2354_201906/)
- Data Dictionary for Advanced Traveler Information Systems (ATIS)(STABILIZED Jun 2019)  
J2353\_201906 [https://www.sae.org/standards/content/j2353\\_201906/?src=j2354\\_201906](https://www.sae.org/standards/content/j2353_201906/?src=j2354_201906)
- ITIS Phrase Lists (International Traveler Information Systems)  
J2540/2\_202012 [https://www.sae.org/standards/content/j2540/2\\_202012/](https://www.sae.org/standards/content/j2540/2_202012/)

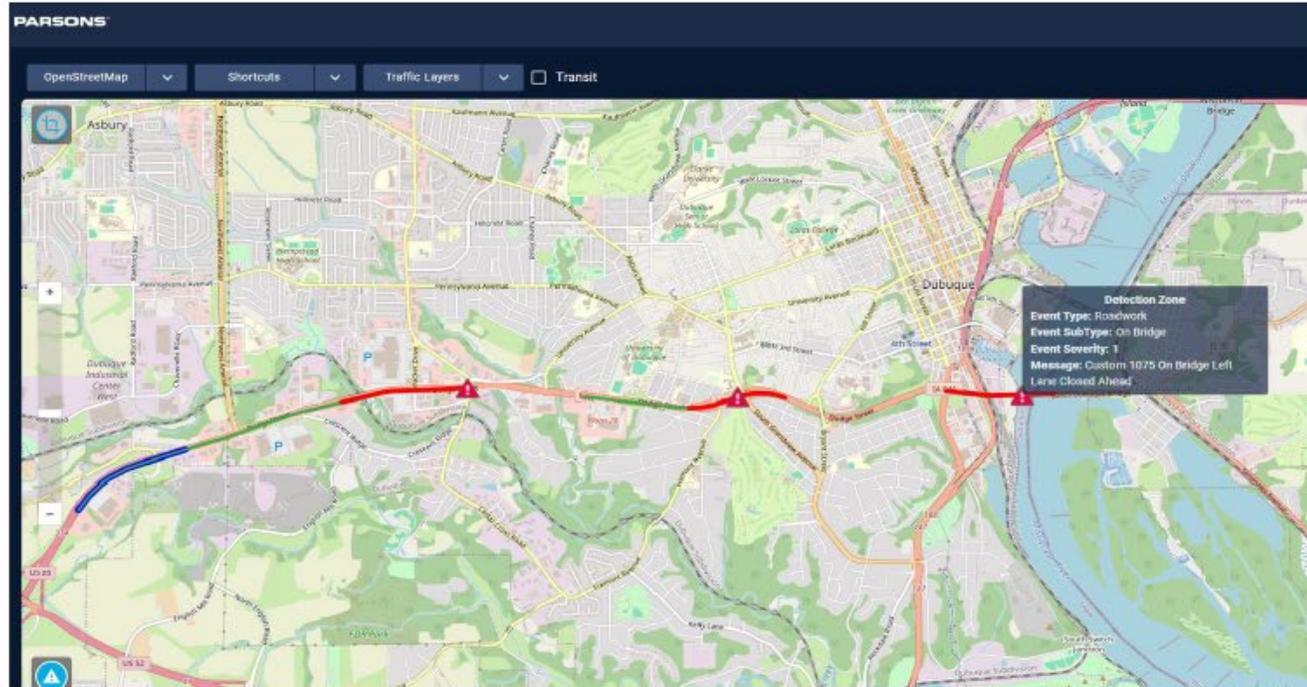
## WZDX

- <https://www.transportation.gov/av/data/wzdx>

# EXAMPLE - ITIS PHRASES

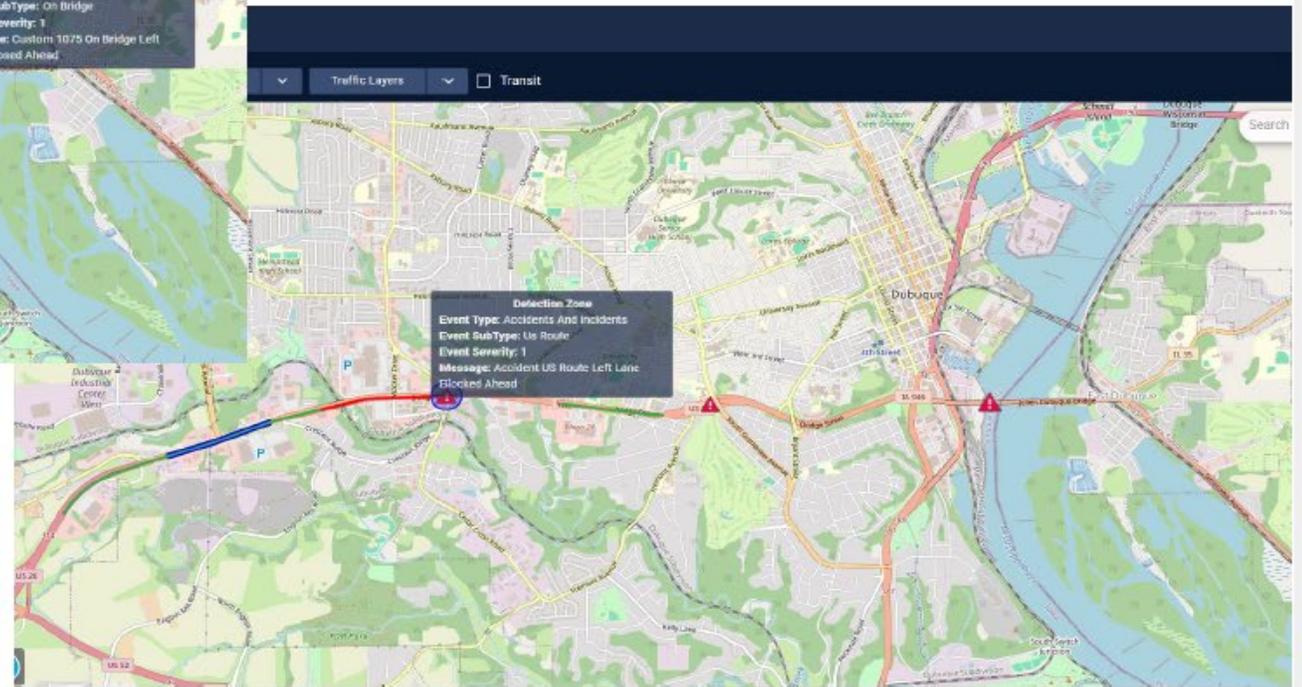
ITIS Phrase	Text
513, 7937, 8195, 771, 13569	Accident on bridge, left lane closed ahead
513, 7937, 8194, 769	Accident on bridge, through lanes closed to traffic
4124, XX 8720, 8765	School zone, XX Speed limit on Weekdays
11024, 775, XX 8728	Railroad Crossing blocked for XX minutes
11024, 894, XX 8728	Railroad Crossing clearing in XX minutes
5377, 5383, 13582, XX 8712	Dense Fog, Visibility reduced next XX Miles
4865, 5906, 7951, XX 8712, 13569	Severe Weather, Ice on roadway, XX Miles ahead

# VEHICLE DATA AGGREGATOR (VDA)



- Consolidates data from all sources
- Converts events to standard TIM and ITIS formats

Set Notification zones for events by type and location ahead of time



# ROADWORK AHEAD / REDUCE SPEED NOTIFICATION



# RED LIGHT ASSIST



# PHASE 2 – WANT TO SUPPORT ALL RELEVANT DATA TYPES

## Operational Prototype Provides:

- **Incidents**

- Can be accidents, signal out, signal flash, weather from RWIS
- Support Subtypes (Like on bridge, spilled load, fire, overturned big rig, high winds, flooding, fog, road damage, etc.)

- **Planned events**

- Can be roadwork, maintenance, special events, school zone notifications, rail crossing (closed/open)

- **Emergency vehicle awareness** (see emergency vehicles and other service vehicles in real time)

- **Would like to add with Phase 2:**

- Advanced rail crossing (Predict train crossing and duration)
- Area special events (not just a point)
- Advanced weather
  - Regional, Road Conditions
- Emergency vehicle warnings
- Parking
- Congestion / predictive travel time
- Add field devices to fill gaps (RWIS, rail system, signal upgrades, etc.)
- Fine tune ATMS and the VDA to support all data types
- Create common regional event input
- Feed back from Vehicles

# ROADWORK EXAMPLE

- Most agencies put out roadwork and special event notices
- How does the SMART GRANT project ingest this from all agencies without duplicate entry
- Basic details important for in-vehicle notifications
- A potential solution would be good for Phase 2 Grant Application
- WZDX standards
- Also applies to special events, other activities



## UPDATE: University Ave, Walnut St. Closed Due to Natural Gas Utility Work

UPDATE 4/23/25: Due to underground natural gas utility repairs, portions of University Ave. are fully closed until 12 p.m. on Wednesday, April 23.

Walnut St. is closed from Jefferson St. to University Ave. until further notice.

Motorists will need to follow the posted detour and/or use a different route during this time. [View a map of current closures/detours.](#)

If you have questions regarding the closure/detour, please contact the City of Dubuque Engineering Department at 563-589-4270. Please note, closure dates and times are estimates and subject to change without notice based on weather and contractor schedules.



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# SYSTEM DEMO

